THE

Malayan Agricultural Journal.

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EDITORIAL.

Large Copra Kilns.

Two articles* by Mr. F. C. Cooke appeared in the pages of this Journal last year dealing with the construction of copra-drying kilns suitable for the produce of small individual areas of coconuts, and with kilns of intermediate size suitable for estates up to 100 acres, or for groups of small-holders. In the present number the author turns his consideration to the construction of large copra kilns, such as are commonly used on the European-owned estates in Malaya.

The type of kiln generally used on the large estates is the so-called Ceylon type. This is a grill drier, the object of which is not to turn out a smoked product, but, by careful working, to obtain the whitest copra possible, uniformly and adequately dried.

In Ceylon, this kiln achieves its object, but under Malayan conditions it has proved less successful. The author has investigated the reason for the lower efficiency of the Ceylon kiln in Malaya and concludes that the absence of definite dry seasons in this country is responsible for this unsatisfactory working. He shews, however, that with very careful supervision of loading and firing and the minimum delay between splitting the nuts and heating, a high percentage of superior copra can be obtained on the Ceylon type kiln in Malaya.

Mr. Cooke has introduced improvements of great value in the construction and working of small and medium-sized kilns resulting in high-speed production of first class copra. The next step in these investigations will be to devise a method of high-speed production of copra on a large scale. Present indications, however, are that the improvements introduced in small and medium-sized kilns are inapplicable to large units.

Tapioca Varieties.

At one time the cultivation of tapioca in Malaya was an important industry. It was grown as a sole crop until the land was exhausted, when the planter abandoned the land and transferred to another site. At a later period in the agricultural development

* Copra Manufacture by F. C. Cooke. *Malayan Agricultural Journal* Vol. XXIV No. 4. Copra Manufacture Part II—Kilns of Intermediate Size by F. C. Cooke. *Malayan Agricultural Journal* Vol. XXIV No. 7.

of this country, tapioca was extensively planted as a catch crop in the establishment of rubber estates. The present economic position of the rubber planting industry has naturally precluded the possibility of further development under these conditions. Consequently the area under this food crop has decreased, but the proportion of the total area planted as a sole crop has increased; in 1935 there were 21,000 acres, of which 4,700 acres existed as a sole crop.

The development of areas as a sole crop is to the advantage of the industry. If cultivated on land held under a permanent title and not under a temporary occupation licence, it will mean that greater care will be taken to maintain fertility and to prevent soil erosion; in fact, the Governments of Malaya now insist on these two points. Further, the planter is led to give greater consideration to economic factors than was the case when tapioca was merely a catch crop. Prominent amongst such economic factors is that of variety of planting material, to produce the heaviest possible crop of high quality, thus lowering cost of production and increasing profits.

In a publication entitled "Tapioca in Malaya", issued in 1933, the Department of Agriculture presented a complete picture of the Malayan industry at that time, together with an account of local investigations on the cultivation of this crop and the method of preparation of the commercial product. Further investigations have since been made, particularly on a comparison of varieties, both local and imported. The results to-date are summarized in an article by Mr. Lambourne included in this number. In view of possible further extensions of tapioca planting in this country, the conclusions reached are of importance and value.

The results of these trials shew that the local varieties, which in the past have been so extensively planted, are inferior in yield to certain imported varieties.

The author adds a word of caution regarding the toxicity of the selected varieties. In Java, the heavy-yielding varieties are employed for the manufacture of tapioca starch. If such varieties are employed in Malaya, consideration must be given to toxicity and palatability, in view of the fact that profit is derived from the sale of the refuse for pig-feeding.

Original Articles.

COPRA MANUFACTURE*

Part III—Large Copra Kilns.

BY
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Introduction.

Of the 200,000 tons of copra produced in Malaya, all but an insignificant fraction is produced on what may be termed for convenience "smoke kilns". The popularity of this type of kiln is to be attributed to the fact that of all the various copra driers employed in the industry in this and other countries, smoke kilns are relatively the simplest and cheapest to build, maintain and operate.

In its simplest and crudest form, the smoke kiln consists merely of an open grill of nibong slats arranged horizontally and supported by four posts a few feet above ground level. The split coconuts are laid on the grill and a litter of mixed combustible rubbish is burned underneath, either continuously or intermittently. Neither the copra nor the fire is, as a rule, adequately protected against rain or wind.

Kilns of this type are of course quite correctly described as "smoke kilns" since the product is often only just sufficiently dried to render it saleable and the heavy film deposited by the smoke on the surface of the half-dried copra serves temporarily to check the progress of deterioration.

The Ceylon Kiln.

The more elaborate type of smoke kiln which is used on estates in this country and in Ceylon is more correctly described as a grill drier, since the object is definitely not to turn out a smoked product, but by careful working, to obtain the whitest copra possible, which must be uniformly and adequately dried and free from those blemishes which are occasioned either by overheating or by the tardy application of heat.

This so-called Ceylon kiln consists simply of an extensive rectangular grill, which is disposed horizontally some seven or eight feet above ground level and covers an enclosed space known as the fire-pit. The kiln is roofed so that manufacture may proceed in all weathers, while a verandah or covered working space is generally provided in front of the kiln.

* This article, since remodelled for publication, was first given as a lecture at the Bagan Datoh Club in November 1936, at the invitation of the Lower Perak Branch of the Incorporated Society of Planters, and in January of this year at the Caledonia Club, Province Wellesley, to members of the Malay Peninsula Agricultural Association.

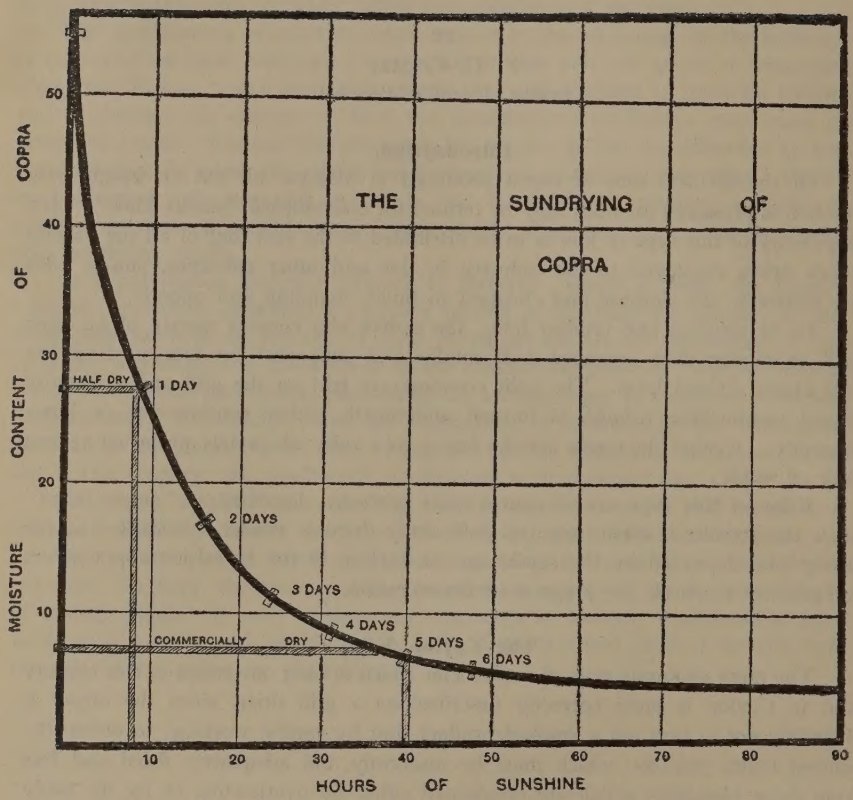

DIAGRAM I.

ILLUSTRATING THE RATE OF DRYING OF COPRA.

There are various elaborations regarding the disposition of the fire-pit doors, the arrangements for ventilation, the protection of the product from the elements, and the disposition of partitions and dividing walls. Furthermore, there is a variety of methods of arranging the copra on the platform and of burning the coconut shells which are used as fuel in the fire-pit, while the load carried, expressed as nuts per square foot, varies on different estates.

By individual ingenuity and closer supervision, it has been possible, in recent years, to effect a marked improvement in the quality of copra produced on estates, but methods have had to be varied according to the type, size and situation of each kiln.

In Ceylon, in 1931, it did not appear that close attention to production was at all necessary. It was noted by the writer that there was a remarkable absence of any spoilage by smoke, by chilling, or by the condensation of moisture on the copra, with the result that no dirty, sticky copra, "red" copra or pitted copra was seen, except on one kiln where there was the grossest neglect. Nevertheless, the identical kiln to that used so easily and successfully in Ceylon will not give the same results in Malaya, following the same method of operation.

The explanation is probably to be found in the fact that in Ceylon the seasons are better defined, particularly in the drier regions and it is possible to place greater reliance on the weather than in Malaya. This, in conjunction with the system of nut storage practised there, makes it possible to confine production to the drier months and to suspend production in bad weather, when manufacture is more difficult.

Furthermore, it is the general practice in Ceylon to lay out the product in the sun for several hours previous to kiln drying. In Malaya, on the other hand, it is not possible to count on long continuous spells of sunshine and cloudless skies except in a few favoured localities and consequently sundrying is seldom practised.

The Effect of Sundrying.

The practice of pre-drying in the sun removes all traces of superficial moisture from the copra and so reduces the degree of smoke and dirt adhesion and gives each piece a protecting skin which can resist the agents of decomposition. Furthermore, it considerably reduces the period of kiln-drying, and finally, it effectively masks the inherent defects of the Ceylon kiln which become most apparent in this country in the stormy months, October to December, when the difficulties of production are greatest.

Eight hours of continuous sundrying with low atmospheric humidity and the sky free from cloud or mist, are actually sufficient to drive off half of all the moisture which has to be removed before the product is commercially dry *i.e.* containing 7 per cent. moisture (Diagram 1). Following this pre-treatment it is easier for the hot air to pass up through the half-dried copra when it is laid out on the grill, than it is through a similar depth of freshly split nuts ("raw" copra). In effect, the period of kiln-drying is halved, so that a load of 30 small Ceylon nuts per square

foot for a kiln in Ceylon is equivalent to a load of between 12 and 15 Malayan nuts per square foot on a kiln of the same type in this country, Malayan nuts being larger.

Kiln Loads.

It will be remembered that a few years ago, in attempting closely to follow Ceylon practice, a simple formula was evolved to determine the correct overall load of nuts a kiln should carry. The formula N/10 per square foot* was first adopted, and many estates in the Bagan Datoh District of Perak had to increase their drying accommodation considerably to operate on this formula. A marked change for the better in the quality of copra produced resulted, but even so, the fact that sun-drying so materially assists production in Ceylon was overlooked.

Later, it was found that even better results were to be obtained if the overall load was still further reduced to N/12; and at the present time, certain kilns are being operated on the basis of N/20 for raw wet copra and N/10 for the semi-dried product after turning. On one estate, the kilns are now being very successfully operated on a four day basis, using the following load formulae: N/18 for the first section, then N/16, next N/14 and lastly N/12 for nearly dry copra. This is equivalent to 13 nuts, 14 nuts, 17 nuts and 20 nuts per square foot, whereas previously the overall load was over 40 nuts per square foot.

It can be objected that operation on the basis of these formulae allows only a very small load of nuts, and that such a method of working would materially increase the capital expenditure on kilns. It must be obvious, however, that sun-drying cannot be omitted in this country without some alternative provision of kiln space for the equivalent amount of drying.

Theoretical Considerations.

The theoretical explanation of the difficulties of copra production in Malaya, when the product is not pre-sundried, is mostly connected with what have been referred to as the inherent defects of the Ceylon smoke kiln.

It is commonly imagined that when the air nearest each individual shell fire is heated, it merely expands, becomes less dense and rises rapidly through the bed of copra and so away to the outer air, carrying with it its complement of moisture evaporated from the copra.

Actually, when the rising hot air comes in contact with the cold "raw" split nuts, the air is very considerably chilled because heat is necessary to effect the evaporation of moisture from the copra. The rising air thus becomes heavier, and its movement becomes sluggish as it rises increasingly and meets still colder copra on top. If the bed of "raw" copra is thick, this slowly rising moisture-laden air can be so chilled that it will re-deposit some of its contained moisture on the colder pieces of copra. These then rapidly deteriorate and become slimy and pitted. Simultaneously, owing to this obstruction above, the free upward

* N = Nut ratio, or number of nuts per picul; thus N/10 gives a total of 25 nuts per square foot.

PLATE I.

OPEN TYPE SMOKE KILN.

See Diagrams II and III.

PLATE II.

CLOSED TYPE SMOKE KILN.

(fitted with baffled ventilation)

See Diagram IV.

movement of the hottest air is checked, with the result that the copra on the bottom may be superficially overdried. The condition known as "case-hardening" is thus produced, and the pieces exhibiting this feature have a scorched skin while the interior is still wet. Furthermore, it may be seen that the fires will burn with some difficulty and with excessive production of smoke owing to the restriction of the free movement of air.

This represents the simple case of the simultaneous chilling and scorching of the product which occurs when the kiln is overloaded, and perhaps also overfired in an attempt to force hot air through a thick bed of "raw" wet copra.

It has further been ascertained that the heat of the various fires burning in the firepit does not, as may be imagined, spread more or less evenly beneath the copra and warm the product uniformly. Actually, the amount of wet copra being heated at any particular instant is strictly confined within the moving circle which constitutes the hot spot over each shell fire. Outside of these zones, the copra may still be warm where a fire has already passed beneath, or cold if away from the influence of the fire-zone.

The area covered by each circle of heat depends on the depth of the firepit; thus with a firepit 6 feet deep, each circle is about 3 feet 6 inches in diameter. With a deeper fire-pit the circle is larger and the heat less intense.

The movement of air within the Ceylon kiln is not so simple as outlined above. Disturbances may arise through the circulation of the air under the influence of convection or through external cold draughts. Convection disturbances are of two types and these may occur simultaneously and may also be upset by draughts from outside the kilns.

With a single shell fire, as the air nearest the flame is heated, and together with the products of combustion rises rapidly up through the heavier surrounding air, colder air moves in towards the fires to replace the air that has moved away. This supply of air may enter partly through ventilation holes let into the walls of the fire-pit, or it may descend through the bed of copra, so completing what may be called a convection cycle.

This can be explained in the following way:—

After passing away from the top of the bed of copra, the hottest air naturally continues to move more or less straight up towards the roof carrying evaporated moisture with it, but there is also air which is less hot or has become so chilled in passing through the bed of wet copra, that on emerging, its movement is sluggish and non-directional. It drifts lazily over the cold surface of the bed, and is thus further chilled so that ultimately it passes down through the copra at some point between fires and back into the fire-pit, redepositing much of its moisture on the copra in doing so. There are also points in the bed of copra where the air is stagnating, and where bacterial decomposition can be initiated if there is prolonged delay before this portion of the copra is heated.

Thus, associated with each fire there is a partial recirculation of air from the fire up through the copra and then back through the copra to the fires. This convection movement or cycle is most pronounced when the fire-pit ventilation is

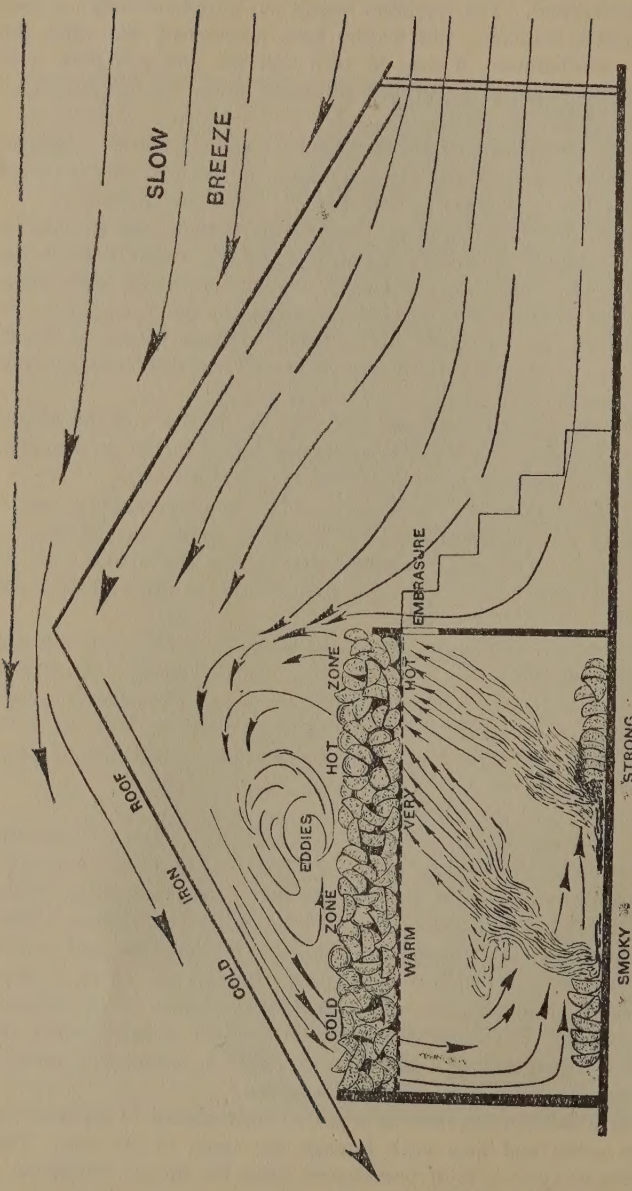

DIAGRAM II.

OPEN SMALL KILN, WITH OPEN VERANDAH AND IRON ROOF.

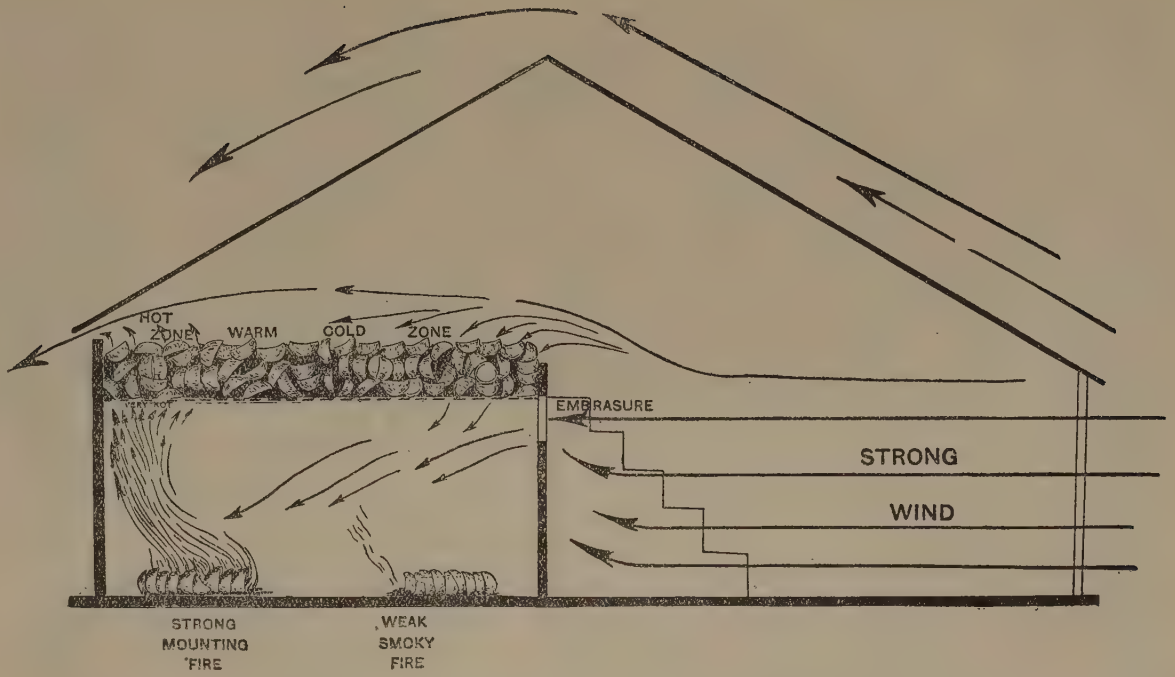

DIAGRAM III.

OPEN SMALL KILN, WITH OPEN VERANDAH AND IRON ROOF.

inadequate, when the shell chains are too long, and the lines of fire are set too far apart.

There is a more serious general convection disturbance occasioned by conditions external to the kiln, which is most pronounced in kilns fitted with a roof of galvanized iron. On cold nights, the working of such a kiln is seriously affected, since much of the hot moisture-laden air rising away from the copra is chilled on coming in contact with the cold roof. Its contained moisture is deposited on the cold surface as dew, and the air, becoming cold and heavy, passes very rapidly down the underside of the roof (Diagrams II and IV).

If such iron-roofed kiln is of the fully-closed type which affords complete protection to the copra from wind and rain, this current of cold air passes down through the copra near the walls and so into the fire-pit. At the same time the flames of the fires in the fire-pit are drawn in towards the centre of the kiln where a hot zone develops, while near the walls the copra remains cold. (Diagram IV)

On the coldest nights, this major convection cycle in the closed type of kiln eclipses the minor convection disturbances, especially when the firing is excessive, when the fire-pit is very extensive and roomy, or when ventilation is inadequate.

Both the minor and major convection movements, which can easily be detected, either by means of smoke fumes or by using an anemometer, can be considerably upset if gusts of wind and draughts of cold air enter the kiln from outside, since their velocity is of a much greater order.

External disturbance can, however, exert little influence in the closed type of kiln (Plate II) if the fire-pit ventilation is properly baffled, and if the top edges of the main roof under the jack-roof are turned up vertically, so as to prevent gusts of wind from entering the kiln and to assist the upward movement of hot air from the copra by the suction created as wind passes across the gap. (Diagram IV).

With the open type of kiln, (Plate I and Diagrams II and III) the external air can, of course, invade the kiln and on stormy nights one of a variety of serious disturbances can be superimposed on, or can upset, the two convection cycles previously described, according to the strength and direction of the wind, the disposition of the ventilating holes in the fire-pit and the position of the fires.

When the wind passes over the wall on the windward side of the kiln, hot air is induced to rise up the inner face of that wall from the fire-pit. If the external wind is at all strong, a hot zone gradually develops to which the flames of all the fires are attracted, while a corresponding cold zone develops on the opposite side of the kiln where the cold wind beats down on the copra. (Diagram III).

Conflagrations.

These disturbances within the kiln can have very serious consequences, since, in addition to the resulting chilling and scorching of the product, due to increasingly pronounced convection movements, a conflagration is liable to occur when all contributory factors, operating simultaneously, favour such a development. Such an event is primarily due to the mounting flames of one particular fire, although

several others may be fanned to exceptional activity at the same time. This mounting of fires may be caused by any or all of the following causes:—

(1) The force of the wind which enters the firepit from outside.
(2) Greatly accelerated burning of the shell fuel due to:
    (a) excessive number of fires in the fire-pit—causing mutual stimulation.
    (b) ground draught in the fire-pit along the fire lines in the direction of burning and resulting in fire spread.
    (c) an acute "U" bend in chains of shells, leading to fire-jump.
(3) The laying of chains too close to the hot walls of the kiln.
(4) The attraction which the strongest burning fire exerts on the remainder, and which one fire can exert on another, if they approach too closely to one another.

Investigations have shewn that pieces of husk, oily string and *attap* require, at normal kiln temperatures, the direct application of a naked flame to bring about their ignition, and that sparks from lively shell fires are insufficiently hot to cause a conflagration. These, together with the factor of incendiarism, have generally been regarded as causes of kiln fires.

Experiments have also shewn that copra and coconut oil are not readily inflammable materials, and require prolonged and direct contact with a flame before they will ignite.

The conclusion has now been reached that "fire-jump", the rapid spread of fires and their mutual stimulation, which causes the flames to mount up and ignite the copra, are either caused by strong draughts in the fire-pit or by the accumulation of excessive heat in the fire-pit due to overloading the kiln, by the use of an excessive number of fires, or inadequate top ventilation. This last factor is responsible for many of the fires which occur principally at night when the roof is cold so that the movement of humid air away from the copra is checked and when a sudden gale may cause wind to enter *via* the jack-roof.

Excessive heat in the fire-pit also causes the shells to give off a mixed inflammable gas at a relatively low temperature (185°C.), and as the shells are dry, the fires naturally spread very rapidly so that progressively more gas is evolved, especially if at this stage ventilation is checked. If the kiln is overloaded, this gas will rise and accumulate under and in the bed of copra and is likely to be ignited by a chance spark when a fire door is opened or when the flames rise sufficiently high. This accounts for the blue "ball of fire" occasionally observed under the bed of copra in kilns at the beginning of a conflagration. The following table provides interesting evidence in support of the above statements:—

Temperature.	**Observation.**
All temperatures:	oily string, dry husk and *attap* can be ignited by a naked flame at all normal kiln temperatures.
80°C.	***Top limit of heat below nearly dry copra*** (3rd day).
100°C.	Nearly dry copra rapidly scorches.

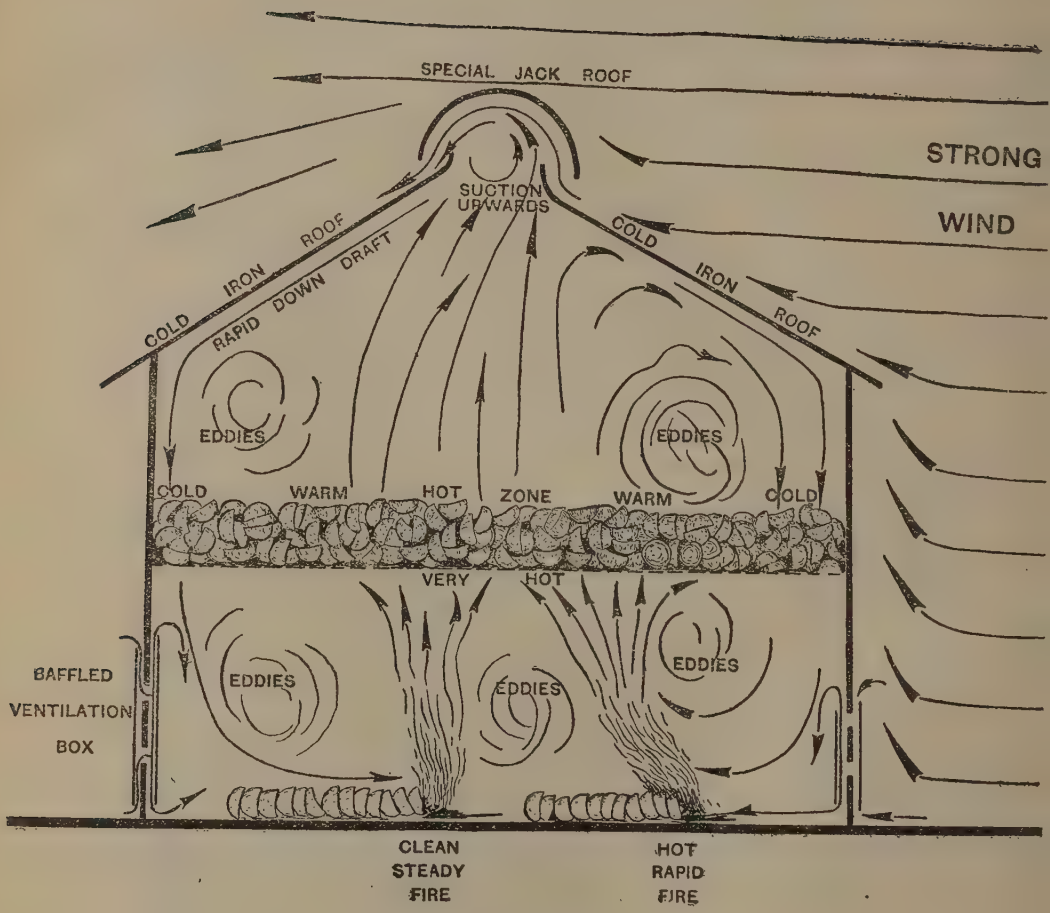

Diagram IV.

CLOSED SMOKE KILN FITTED WITH AN IRON ROOF.

Note:—Internal and external baffling to check draught.

120°C. *Top limit of heat below half dry copra* (2nd day).
130°C. Non-inflammable gas (mostly water vapour and CO_2) given off by coconut shell.
140°C. *Top limit of heat below "raw" copra* (1st day).
150°C. Husk smokes.
160°C. Oily string smokes.
180°C. Non-inflammable gas given off by copra.
182°C. *This temperature was recorded under copra in a kiln without a conflagration occurring.*
185°C. *Mixed inflammable gases* given off by coconut shell.*
200°C. Oil begins to exude from scorched copra.
220°C. *Oily string and husk glow and may ignite spontaneously.*
220°C. *Dry copra smokes and can immediately be ignited on first contact with a naked flame.*
230°C. Coconut oil can be ignited immediately on contact with a naked flame.
240°C. Inflammable gas given off by copra.
250°C. Oil exudes freely from copra.
300°C. Copra burns very fiercely after contact with a naked flame.

If no extra air is admitted to the fire-pit and the copra is not disturbed, a considerable time usually elapses (often as much as an hour) before a kiln is properly alight and beyond all hope of saving. The "ball of fire" may be seen below the bed of copra or some of the copra may actually be alight, but this condition will persist for a considerable time. It is thus frequently possible, if the fireman is alert, to save the kiln by the simple expedient of pouring water on to the copra above the place where the fire is developing, but *the fire doors must not be opened nor must the copra be disturbed,* otherwise a strong current of air develops and the flames are fanned to even greater activity.

Where there is a piped water supply, a useful adjunct to the kiln is a standpipe and hose at a convenient level for the application of water to the bed of copra. On many estates, a shallow well is dug near the kiln and there is a supply of fire buckets in the verandah. It should be noted that very little water is required, as when the water falls into the overheated fire-pit, volumes of steam are produced which quickly douse the fires.

Experimental Procedure.

For some considerable time it was difficult to interpret what actually was occurring when a kiln would not function properly, and it was not until small-scale models of each type of kiln, fitted with glass observation panels, were used that it was possible to vary operating conditions at will and study the movement of the air currents within the kiln. Small candles were used to represent shell fires and chopped coconut meat was substituted for copra; the roof was chilled

* Mostly hydrocarbons, carbon monoxide and hydrogen with carbon dioxide also present, and fumes of naphtha and light tar.

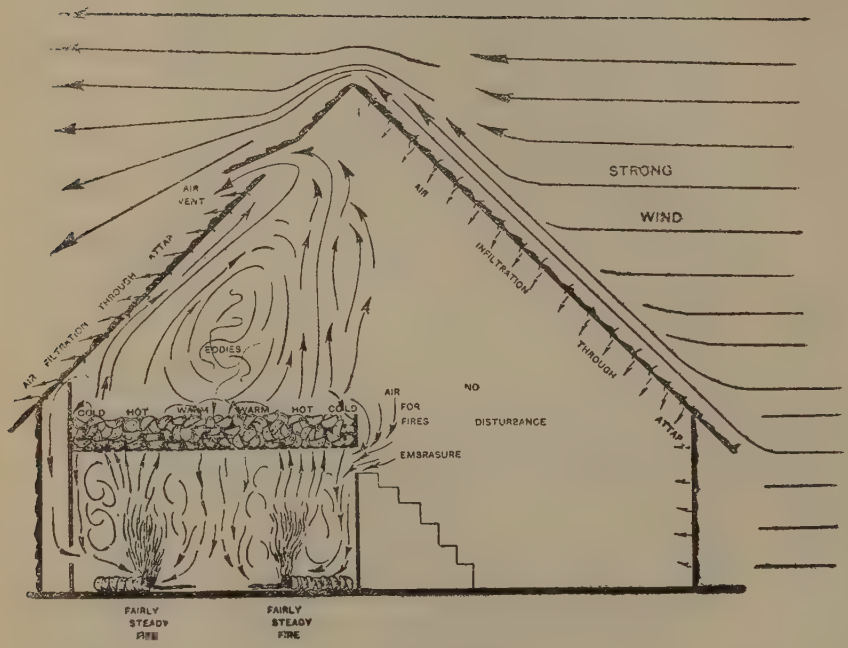

DIAGRAM V.

CLOSED SMOKE KILN, WITH ATTAP ROOF.

The fires progress steadily, making a travelling 5 foot circle of heat under the copra.

by ice water to represent night conditions or jacketed with cotton wool to simulate sun-warming; a slow running fan placed in different positions with respect to the kiln produced the external wind, while contact between ammonia gas and hydrochloric acid fumes yielded a dense white cloud, which was used to trace the currents of air. The results, so obtained, which have been confirmed by observations on large kilns, have provided the key to the difficulties of copra production in this country.

Practical Conclusions.

The general conclusions are that, while the open type iron-roofed kiln can be relied upon to operate satisfactorily with favourable weather conditions, its efficiency is considerably impaired at other times. The closed iron-roofed kiln will function very satisfactorily when the sun is shining, but at night it is less efficient; at the same time, its working is not so seriously upset in stormy weather nor is the fire risk so serious. It should also be mentioned that *attap,* although requiring frequent renewal, provides a highly satisfactory material of construction for closed kilns, since when it is used convection cycles are not so pronounced, air can diffuse uniformly through the leaflets and on cold nights the influence of external conditions is very considerably less serious (Diagram V). For roofing, Marseilles tiles or wooden shingles are alternatives to the use of *attap.*

In the foregoing, there has been little but destructive criticism of the smoke kiln and possibly some over-emphasis of the weak features of this type of kiln. Yet the fact remains that, with careful supervision of firing and loading and the minimum of delay between splitting and heating, a high percentage of superior copra is now being obtained with such kilns in Malaya.

Nevertheless, even with the most careful supervision and control, hot zones and cold zones can generally be detected in the bed of copra, more especially on cold nights and in windy weather, so that a product of more or less mixed quality results. Under such conditions and in spite of the frequent turning of the copra, it is still possible for under-dried pieces to be present in the finished product.

The problem of rapidly and cheaply producing good copra under Malayan conditions of production has recently been approached from a new angle. From the conclusions previously outlined, it will be obvious that many hours may elapse before certain portions of a bed of raw copra laid out in the platform of a smoke kiln receive any heat, while at the same time other parts are actually being overheated and overdried. At any particular instant about one-sixth of the copra is being heated, roughly one-third is warm, and the remainder is cold and in process of deterioration particularly if there has been serious previous delay.

It will be seen that if, without intensifying the degree of heat applied, the whole of the copra could be continuously heated, the time of manufacture could be considerably curtailed and better copra could more easily be obtained. In the case of large smoke kilns, this would require that the number of fires burning in the fire-pit be trebled. But if this be done, a conflagration is certain owing to the mutual stimulation, quickening and attraction of the various fires which in turn will cause rapid spread of fire and result in mounting flames.

High-Speed Kilns.

In the new high-speed kilns described in Parts I and II of this series of articles, the risk of conflagration has been removed by isolating the fires either singly or in pairs. The kilns described are designed primarily for the use of small-holders, but investigations are now being carried out with a view to evolving a large kiln operating on the same principle for use on estates.

Summary.

1. The Ceylon-type copra-drying kiln is described. It has been found that this kiln gives less satisfactory results in Malaya than in Ceylon.

2. It is thought that the more definite seasons in Ceylon, coupled with the system of nut storage and the preliminary period of sun-drying employed in that Colony are responsible for the more satisfactory results there obtained with the Ceylon kiln.

3. Sun-drying before drying on the kiln is discussed. The kiln-drying is more effective and a greater number of nuts may be kiln-dried at one time if the copra receives a preliminary and partial sun-drying.

4. The movements of hot air and the process of drying on the kiln are explained, by which it is shewn that the difficulty with this type of kiln is that the heat is not evenly distributed throughout the kiln, resulting in uneven drying of the load.

5. The causes of conflagrations are enumerated and the effect on the drying copra of different temperatures is stated.

6. It is concluded that while this type of kiln is not fully efficient in Malaya, yet with greater attention to details of operation a high percentage of superior copra may be obtained.

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TAPIOCA VARIETAL TRIALS

BY

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Introductory.

During the past 15 years a large number of varieties of tapioca has been collected at the Central Experiment Station, Serdang, with a view to obtaining improved and high-yielding varieties. They were obtained from the Philippine Islands, Java, and Mauritius, and from different parts of the Malay Peninsula. There are forty varieties in the present collection, but several are apparently synonymous although they have been introduced under different names. A complete list of the varieties, together with their origin and descriptions based on vegetative characters, has been published by the Department ([1] and [2]).

In these publications will also be found the results of a number of trials with groups of three varieties which were carried out previously, but replicated plots of all varieties together in one block were not laid down until 1933.

The collection became unwieldy and the trials hereunder described were laid down with a view to eliminating all but ten of the best yielders. During the period December, 1933 to April, 1936, two yield trials with the varieties in the collection were carried out. The first of these was laid down in December, 1933, and harvested in December, 1934, the second was planted in December, 1934, and harvested in April, 1936.

Trial I.

The area selected for the trial consisted of 2½ acres of flat land in Block 24. The soil is a valley quartzite type, being a dark sandy loam having 30 to 40 per cent. fine fractions. The area was first opened in 1923, when it was cleared of light jungle. Subsequently, the land carried crops of Caraguata fibre (*Bromelia argentina*), tapioca, *Crotalaria anagyroides*, and sweet potatoes. Cattle manure at the rate of 5 tons per acre and oil palm bunch refuse at the rate of 10 tons per acre were turned into the soil before the sweet potato crop was planted. No manure was applied for the tapioca before planting, but when the plants had become established, a dressing comprising 3 cwts. basic slag and 1 cwt. sulphate of potash per acre was applied and worked into the soil between the rows.

In this trial, thirty-six varieties were planted in plots of 1/80th acre each, the lay-out consisting of five replications in randomized series across the block. The cuttings were planted three feet apart each way, with sixty cuttings in each plot. Three of the highest-yielding varieties in previous trials and "Native No. 1" were omitted from the present trial as there was insufficient planting material.

Harvesting took place in December, 1934, the results of which are given in Table I. Only half of each plot in Series (E) was harvested, in order to reserve cuttings for a second trial. In consequence, this series has been omitted from the calculations and the trial treated as four randomized blocks.

Trial II.

This trial was laid out in an adjacent block of flat land (Block 23). The soil is of the same type as Block 24, but varies from west to east from a clay loam to a sandy clay loam having 50 to 60 per cent. and 40 to 50 per cent. fine fractions respectively. Approximately half the area is situated on each type of soil. This area was opened at the same time as Block 24, and since then has carried crops of sisal hemp, green manure (*Crotalaria usaramoensis*), tobacco, and *Crotalaria usaramoensis* a second time. Farmyard manure and different artificial mixtures were applied to the tobacco crop two years previously, but beyond the turning in of the green manure before planting, no treatment was given for the tapioca crop until March, 1935, when a complete mixture consisting of calcium cyanamide 1 cwt., rock phosphate 2 cwts., and sulphate of potash ½ cwt. per acre was applied. In this trial, forty varieties were planted in 1/73rd acre plots randomized in four series; there were sixty-six cuttings planted in each plot, the planting distance being 3 ft. x 3 ft.

Harvest was unavoidably postponed until April, 1936, when suitable weather occurred for planting the ten highest yielders in a further trial.

Discussion of Results.

Yields in pounds of tapioca root per plot together with the mean yields per plot for the two trials are given in Table I. Statistical treatment of the results shows that a difference between plot means of 94 lbs. and 109 lbs. respectively, for the first and second trials, is required for significance.

It will be seen (Tables I and II) that in both trials Mandioca Criolinha is the best yielder, thus confirming previous results (1). In the second trial, Aipin Manteiga may perhaps be equally good as regards yields, for the difference between these two varieties is not significant. Aipin Manteiga may be bracketed with M. Basiorao, M. Sao Pedro Preto and M.S.P.P. 1964; M. Basiorao with Aipin Mangi, Beureum and Native No. 6; and Aipin Mangi with M.S.P.P. 239, M. Itaparica and Pacho 3. M. Itaparica, which is the lowest yielder of the ten selected varieties, can be bracketed with M.S.P.P. 239, Pacho 3, Native No. 4, Aipin Tapicuru, Manioc de Table and Icery, but the first ten in order of merit have been selected for further trial.

A number of these ten selected varieties have proved to be high yielders in previous trials (1 and 3), namely M. Criolinha, Aipin Manteiga, Aipin Mangi, M. Itaparica, M. Sao Pedro Preto, M.S.P.P. 239 and M.S.P.P. 1964.

The calculated yields per acre given in Table II show the advantage to be derived by tapioca planters from a wider use of these high-yielding varieties. By their use it may be possible to increase yields very considerably. Examination of the tables shows that, with the exception of Native No. 6, which is grown in Kedah, and Native No. 4, which is grown on native holdings in Selangor and other parts of the Peninsula, the native varieties are comparatively poor yielders.

Table I.

Mean Yields of Tapioca in lbs. per plot from Two Trials and Percentages of the General Means.

Variety	Block 24		Block 23		Totals	Means
	Plots 1/80th of an acre 1934	Percentage general mean.	Plots 1/73rd of an acre	Percentage general mean.		
Criolinha ...	596	225	672	273	1,268	634
Aipin Manteiga ...	—	—	571	230	571	571
M. Basiorao ...	481	182	501	202	982	491
M. Sao Pedro Preto ...	409	154	541	218	950	475
M.S.P.P. 1964 ...	—	—	475	191	475	475
Aipin Mangi ...	472	178	360	145	832	416
Beureum ...	363	137	438	178	801	400
Native No. 6 ...	452	171	342	138	794	397
M.S.P.P. 239 ...	340	128	369	149	709	354
M. Itaparica ...	365	138	338	136	703	351
Pacho 3 ...	336	127	320	129	656	328
Native No. 4 ...	324	122	257	104	581	290
Aipin Tapicuru ...	290	109	267	108	557	278
Manioc de Table ...	274	103	279	112	553	276
Icery ...	325	123	211	85	536	268
Constantin ...	260	98	240	97	500	250
Native No. 11 ...	205	77	276	111	481	240
Bunch of Keys ...	335	126	133	54	468	234
Negrito 15 ...	290	109	163	55	453	226
Butterstick ...	273	103	173	71	446	223
Trinidad 2 ...	297	112	131	53	428	214
Kapo ...	186	70	242	98	428	214
Native No. 1 ...	—	—	214	86	214	214
Mauritius 29 ...	208	78	209	84	417	208
Native No. 7 ...	242	95	158	64	400	200
Native No. 10 ...	217	82	163	66	380	190
M.S.P.P. 2152 ...	141	53	212	85	353	177
Singapore ...	—	—	176	73	176	176
Australie ...	211	80	135	54	346	173
Native No. 13 ...	182	69	158	64	340	170
Native No. 8 ...	191	72	123	50	314	157
Native No. 12 ...	153	58	144	58	297	148
Negrito 17 ...	134	51	157	62	291	145
Cabesadura ...	130	49	157	62	287	143
Negrito 12 ...	161	61	113	46	274	137
Paloma ...	163	62	102	41	265	132
Blancite ...	152	57	99	40	251	125
Smallings ...	133	50	113	46	246	123
Rodney ...	124	47	117	47	241	120
Blue Top ...	138	52	65	26	203	101
General Means ...	265		248			251
Difference between variety means necessary for significance, lbs. ...	94		109			
Percentage General Mean	35		44			

Table II.

Yields of Tapioca per acre calculated from the Mean of four Replications.

Variety.	1933/34 Trial.			1934/36 Trial.		
	lbs. per acre.	Tons per acre.	Piculs per acre.	lbs. per acre.	Tons per acre.	Piculs per acre.
Criolinha ...	47,680	21.28	357.60	49,056	21.90	367.92
Aipin Manteiga ...	—	—	—	41,683	18.61	312.62
Basiorao ...	38,480	17.18	288.60	36,573	16.33	274.30
M. Sao Pedro Preto ...	32,720	14.61	245.40	39,493	17.63	271.25
M.S.P.P. 1964 ...	—	—	—	34,675	15.48	260.06
Aipin Mangi ...	37,760	16.86	283.20	26,280	11.73	197.10
Beureum ...	29,040	12.96	217.80	31,974	14.27	239.80
Native No. 6 ...	36,160	16.14	271.20	24,966	11.15	187.24
M.S.P.P. 239 ...	27,200	12.14	204.00	26,937	12.03	202.03
Itaparica ...	29,200	13.04	219.00	24,674	11.02	185.05
Pacho 3 ...	26,880	12.00	201.60	23,360	10.43	175.20
Native No. 4 ...	25,920	11.57	194.40	18,761	8.38	140.71
Tapicuru ...	23,200	10.36	174.00	19,491	8.70	146.18
Manioc de Table ...	21,920	9.79	164.40	20,367	9.09	152.75
Icery ...	26,000	11.61	195.00	15,403	6.88	115.52
Constantin ...	20,800	9.73	156.00	17,520	7.82	131.40
Native No. 11 ...	16,400	7.32	123.00	20,148	8.99	151.11
Bunch of Keys ...	26,800	11.96	201.00	9,709	4.33	72.82
Negrito 15 ...	23,200	10.36	174.00	11,899	5.31	89.24
Butterstick ...	21,840	9.75	163.80	12,629	5.64	94.72
Trinidad 2 ...	23,760	10.61	178.20	9,563	4.27	71.72
Kapo ...	14,880	6.64	111.60	16,666	7.44	125.00
Native No. 1 ...	—	—	—	15,612	6.97	119.59
Mauritius 29 ...	16,640	7.43	124.80	15,257	6.81	114.43
Native No. 7 ...	19,360	8.64	145.20	11,434	5.10	85.75
Native No. 10 ...	17,360	7.75	130.20	11,899	5.31	89.24
M.S.P.P. 2152 ...	11,280	5.04	84.60	15,476	6.91	116.07
Singapore ...	—	—	—	12,848	5.56	96.36
Australie ...	16,880	7.54	126.60	9,755	4.35	73.16
Native No. 13 ...	14,560	6.50	109.20	11,434	5.10	85.75
Native No. 8 ...	15,280	6.82	114.60	8,979	4.01	67.34
Native No. 12 ...	12,240	5.46	91.80	10,512	4.69	78.84
Negrito 17 ...	10,720	4.79	80.40	11,461	5.12	85.96
Cabesadura ...	10,400	4.67	78.00	11,461	5.12	85.96
Negrito 12 ...	12,880	5.75	96.60	8,249	3.68	61.87
Paloma ...	13,040	5.82	97.80	7,446	3.32	55.84
Blanciti ...	12,160	5.43	91.20	7,227	3.23	54.20
Smallings ...	10,640	4.75	79.80	8,249	3.68	61.87
Rodney ...	9,920	4.43	74.40	8,541	3.81	64.06
Blue top ...	11,040	4.93	82.80	4,745	2.12	35.59
Difference between varieties necessary for significance ...	7,511	3.40	56.34	7,938	3.54	59.54

Toxicity is a factor of some importance when considering the question of utilization of the roots, which may be used for the manufacture of starch or as a vegetable.

It is well known that tapioca root (and other parts of the plant) contain a cyanogenetic glucoside and an associated enzyme which liberates prussic acid. The toxic content of the root varies both in amount and distribution. Thus, certain varieties contain a high percentage of the glucoside in both bark and flesh of the roots while others contain a high percentage in the bark, but comparatively little in the flesh. The prussic acid content of the roots of all the varieties mentioned in the tables has been determined and the results were published in a Special Bulletin of the Department (1). These determinations can be taken only as a guide, for this characteristic of the root has been known to vary under different soil conditions. The varieties M. Basiorao, A. Tapicuru and M.S.P.P. Nos. 3718, 3795, 3536, 2159 and 1964 contain a fairly high percentage of prussic acid both in the bark and flesh of the roots, while Aipin Manteiga, M. Itaparica, and Rodney contain only small amounts. The prussic acid content of the flesh of the roots of all the native varieties is low, but in most of them there is a high percentage in the bark.

Greenstreet (1) has shown that the enzyme is activated when the cells of the roots are ruptured by mincing, also that the enzyme is destroyed by boiling. Further, his experiments showed that complete elimination of the prussic acid could only be assured by mincing the root and soaking in water for at least one hour, followed by boiling.

In the process of tapioca starch extraction, the roots are washed and roughly peeled in a revolving wooden cylinder, after which they are grated. A stream of water carries the grated root into a muslin sieve, which is made in the form of a cylinder and revolves. There is a constant spray of water both on the outside and inside of the sieve and the starch passes through the muslin in suspension, while the residue or "hampas" is thrown out at the end of the cylinder. The starch is further purified by washing with water, followed by sedimentation. The conditions under which extraction of the starch and its purification are effected favour the formation of prussic acid, also its elimination in the wash water. The reduction by this means of the toxic content to an innocuous proportion in the finished product was confirmed by Greenstreet (1) who showed that the prussic acid content of the starch was of the order of 0.001 per cent. It follows, therefore, that all the varieties mentioned may be used for the manufacture of tapioca starch.

Confirmation of this is found in agricultural practice in Java where the heavy-yielding varieties containing a high proportion of glucoside in the flesh of the roots are used for the manufacture of tapioca starch. Such varieties are considered to be the best for this purpose because the roots are less liable to be damaged in the field by animal pests.

In Malaya, the "hampas" is largely used in the wet state for feeding pigs and the manufacturer relies for a proportion of his profits upon the sale of this by-product for that purpose. Although undoubtedly a large proportion of the prussic acid must be removed during the process of grating the root and washing the starch it is possible that the "hampas" from the high-yielding varieties (*e.g.* M. Criolinha, M. Basiorao, M. Sao Pedro Petro and A. Manteiga) may be more toxic,

also less palatable, than that from the varieties used at present. Apart from the question of toxicity, it is important that the "hampas" should be palatable, and from observations on damage caused by rats and monkeys at the Central Experiment Station, Serdang, it was found that the roots of varieties vary in this respect. For instance, Native No. 1 and Aipin Manteiga have been grown under the same conditions. The first was badly damaged by rats and monkeys while the second was not damaged, yet according to analysis the roots of both contain a comparatively small percentage of the glucoside.

When used as a vegetable, the fresh root is peeled and boiled, sometimes cut in slices. Since boiling destroys the enzyme and therefore prevents the formation of prussic acid it follows that only those varieties the flesh of which has a low glucosidal content should be used for this purpose. Further, it should be emphasised that even those varieties that contain only a small amount of the toxic principle are liable to become poisonous if not cooked and eaten immediately they are lifted from the ground.

Summary.

1. Two yield trials with the tapioca varieties in the collection at the Central Experiment Station, Serdang, are described.

2. The trials were carried out with a view to eliminating all but the ten best yielding varieties.

3. It is shown that there is a wide difference in yield of roots between varieties grown under similar conditions and, by making use of these high-yielding varieties, the tapioca planter may be able to increase considerably his output per acre.

4. The high-yielding varieties which contain a comparatively high percentage of the toxic principle are largely used in Java for the manufacture of tapioca and a certain amount of dried "hampas" is exported chiefly to Europe and sold as food for stock. In Malaya where the "hampas" is used in the moist state direct from the factory the question of toxicity and palatability needs to be investigated.

5. It is emphasised that tapioca roots should be freshly dug, peeled and boiled before eating, since even those varieties with a low toxic content are liable to be poisonous if allowed to become stale before cooking.

Acknowledgment.

Mr. T. D. Marsh was responsible for supervising the harvesting and for reporting upon the first trial, also for laying out and planting the second. Full use of his reports has been made in the preparation of this article.

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2. "A Preliminary Report on Tapioca as a Catch Crop with Oil Palms" by J. Lambourne, *Malayan Agricultural Journal*, Vol. XV, 1927.
3. "A Preliminary Report on Tapioca Varieties at the Government Experimental Plantation, Serdang" by J. Lambourne, *Malayan Agricultural Journal*, Vol. XV, 1927, p. 41.

Received for publication December, 1936.

Abstract.

TWENTY-EIGHTH REPORT ON NATIVE RUBBER CULTIVATION IN THE NETHERLANDS INDIES*.

Prices.

The Batavia quotation for Java Standard Sheet in the first half of July was in the neighbourhood of 24½ cents per ½ kg. Until the beginning of September the market continued to be weak. In the first half of September prices fluctuated between 23¾ and 24 cents per ½ kg. A somewhat firmer market was seen during the second half of September.

Following the abandonment of the gold standard in the Netherlands on September 27th, no commodity prices were quoted for two days. On September 30th Batavia quoted a price of 29½ cents, which was 20 per cent. above the former level. The uncertain value of the guilder caused speculation, which was particularly so in the case of native rubber during the first few days following the devaluation. During the month of October, quotations were subjected to daily fluctuations varying between 30¼ and 31¾ cents per ½ kg. The decision of the International Rubber Regulation Committee on October 27th, establishing the restriction percentage for the first half of 1937 at 30, was favourably received by the market, prices going up at the beginning of November from 32 cents to 33¾ cents per ½ kg.

The monthly averages of the daily quotations per ½ kg. of Java standard sheet for the first ten months of 1936 were consecutively: 20.4, 22.2, 22.7, 23.4, 22.9, 23.4, 24.2, 23.9, 24.4 and 31.3 cents.

The prices of medium blanket in Singapore fluctuated during the quarter under review, at a level that was from 1.9 to 0.2 per cent. below that of Standard Sheet.

The Export Tax.

The trend of prices was constantly closely followed by increases or decreases in the special export tax on native rubber. On June 24th this tax was raised to 35 cents per kg. dry native rubber. An increase followed on July 9th to 35 cents. When it became known that in spite of this high tax the month of July showed a record export, the tax was raised to 37 cents on August 2nd, this level being maintained until the announcement of the abandonment of the gold standard. From September 23rd, no difference was made, except in the region of Palembang, between dry and wet rubber in the levying of this special export tax, so that beginning from that date all rubber was subjected to the same tax. In Palembang a tax, amounting to 90 per cent. of the normal tax, was still levied on wet rubber.

The abandonment of the gold standard made it necessary for the export tax to be drastically raised in order to prevent production being stimulated as a result of an advance in prices in the interior. On the day exchange was opened after

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* Abstract from *Netherlands Indies*, Vol. IV, Nos. 20, 21, 22. December 1, 1936.

the currency depreciation, the special export tax was therefore raised by the increase in terms of guilders in the price of rubber in Batavia, namely from 37 to 47 cents, and at the same time the periods of grace for the application of this tax on blanket and sheet—namely 30 and 12 days respectively—were, as a temporary measure, abolished.

Since these new measures would have caused exporters an unfair loss, particularly in respect of forward sales contracts closed in guilders or closed in foreign currencies and covered in guilders, the Government decided, in such cases, to grant a compensation for the loss incurred. This decree removed a great deal of the anxiety which at first prevailed in the large exporting centres.

On October 1st, 4th, 8th, 11th and 20th, revisions were made in the tax to 48, 50, 51, 52 and 51 cents respectively. Simultaneously with the subsequent revision to 52 cents on November 1st, the special arrangement for Palembang, where the export tax on wet rubber still amounted to 90 per cent. of that on dry rubber, was abolished, so that from that date all exports of native rubber from the Netherlands Indies were subject to one and the same tax. Further increases followed on November 3rd, 6th and 8th to 53, 54 and 55 cents respectively.

Together with the increase on November 8th the periods of grace for blanket and sheet were again introduced in order that the trade in these products might (considering the time required for the preparation, smoking and sorting out of such types of rubber) again be given a sound basis for the operation of its business.

During the third quarter of 1936 these exports amounted to 40,794 tons*†, which is 691 tons more than the allotted quota (39,903 tons). The exports during the first nine months of this year—excluding 30 tons which were for the account of the 1935 restriction year—totalled 114,383 tons, or 812 tons more than the allotted quota (113,571 tons). If the provisional figures for the tenth month, October, were to be added, it would become evident that the exports up to November had amounted to 126,327 tons, or 545 tons below the quota of 126,872 tons. It may therefore be assumed that the application of the export tax system has had the desired effect and that the obligations entered into have been successfully fulfilled.

Exports.

A review of the total monthly exports of native rubber in 1936 and of the quarterly exports of native rubber in 1935 and the first three quarters of 1936 are given in the tables following.

In Table I, the monthly production is roughly estimated by consideration of movements of stocks held by accredited exporters.

A satisfactory explanation of the large production in June and particularly in July cannot be elicited from the local reports. It is highly probable that there were several contributing factors: diminished seasonal activities for the cultivation

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* The metric ton of 2,200 lbs.
† Provisional figures, since the figures for September are not yet final.

Table I.

Monthly Exports of Native Rubber, in metric tons. (dry equivalent).

Month	Allotted export quota	Exports	Movements of exporters' stocks	Estimated production
January, 1936 ...	12,278	9,330	—2,096	11,426
February „ ...	„	16,397	—3,511	12,886
March „ ...	„	9,489	—2,183	11,672
April „ ...	„	12,725	—1,114	11,621
May „ ...	„	10,849	— 665	11,514
June „ ...	„	14,817	— 116	14,933
July „ ...	13,303	18,368	— 303	18,065
August „ ...	„	11,949	— 151	12,100
September „ ...	„	10,477	— 998	11,475
October „ (provisional) ...	„	11,944	— 676	11,268

Table II.

Quarterly Exports of Native Rubber, in metric tons. (dry equivalent).

Quarter	Group 1a blanket	Group 1b sheet	Group 11a sheet	Group 11b slab	Total	1a + 1b in % of total
1st quarter 1935 ...	8,299	7,924	953	18,863	36,039	45.2
2nd „ „ ...	13,851	15,508	1,009	20,646	51,014	57.7
3rd „ „ ...	10,230	9,514	19	8,097	27,860	70.9
4th „ „ ...	13,104	12,452	16	4,361	29,933	85.4
Total 1935 ...	45,484	45,398	1,997	51,967	143,846	62.7
1st quarter 1936 ...	13,123	15,073	162	6,858	55,216	80.1
2nd „ „ ...	14,413	16,976	135	6,877	38,401	81.7
3rd* „ „ ...	16,251	17,317	82	7,144	40,794	82.3

* Figures for third quarter are provisional.

of food crops in important rubber districts, favourable weather conditions, the need for cash for the settlement of taxes, etc. A slight increase in the pressure of the export tax in the subsequent months brought the exports of native rubber back to the desired level again.

Table III.

Exports of Dry Native Rubber, in metric tons.
(dry equivalent.)

Quarter	Consuming Countries					Singapore & Penang	Total
	U.S.A.	Europe	Japan	Australia	Total		
Blanket							
1935: 1st quarter ...	4,208	886	411	—	5,505	2,794	8,299
2nd „ ...	7,986	851	184	—	9,022	4,823	13,845
3rd „ ...	6,270	744	146	—	7,160	3,006	10,166
4th „ ...	6,887	1,062	324	—	8,273	4,789	13,062
Total ...	25,351	3,543	1,066	—	29,960	15,412	45,371
1936: 1st quarter ...	7,154	453	307	—	7,914	5,209	13,123
2nd „ ...	8,234	657	470	—	9,361	4,952	14,313
3rd „ ...	9,348	446	772*	3	10,669	5,569	16,238
Sheet							
1935: 1st quarter ...	432	168	455	—	1,055	6,917	7,972
2nd „ ...	1,217	278	473	—	1,968	13,539	15,507
3rd „ ...	1,533	513	167	—	2,213	7,326	9,539
4th „ ...	1,079	316	683	—	2,078	10,374	12,453
Total ...	4,261	1,275	1,778	—	7,314	38,156	45,470
1936: 1st quarter ...	1,747	244	270	—	2,261	12,818	15,073
2nd „ ...	3,513	242	349	10	4,114	12,963	17,077
3rd „ ...	4,946	168	713	—	5,827	10,997	16,824

* Including one ton to China.

The exports from Tapanuli, Sumatra's West Coast, Banka and the Western Division of Borneo consist entirely of dry rubber, and almost the same is the case with the exports from Djambi, and the Southern and Eastern Division of Borneo. In Palembang the percentage is increasing, in Sumatra's East Coast it is fairly steady, in Acheen it is very fluctuating, whereas in Riouw it has dropped sharply, perhaps because the difference in the export tax on dry and wet rubber in Indragiri made an extra margin of profit possible by shipping almost dry rubber as wet rubber.

Registration of Native Plantations and Experimental Tappings.

By the end of the quarter under review, the registration of native rubber plantations, in so far as the field work was concerned, had been approaching completion in the majority of the territories. On the day this report was closed the only district where the registration was still in progress was Banka, and it is anticipated that this too will be completed by the end of November. The work of assembling the registration data in the Central Bureau of Rubber Restriction at Batavia is progressing satisfactorily, and for certain districts a start has already been made with the issue of production permits, so that it may be anticipated with sufficient certainty that by January 1st, 1937, the individual restriction will become a fact in all native rubber districts, and that the rather fluctuating and unsatisfactory special export tax will be a thing of the past.

Based on the available results of the 850 experimental tappings correctives were established for planting distances and quality classifications, which are being used for the determination of the individual basic productions. Some 400 experimental tappings are being continued till the end of 1936, with a view to increasing the reliability of the production figures.

Review.

Lac in Malaya, Part II.

By N. C. E. Miller, Acting Government Entomologist, Special Bulletin Department of Agriculture, S.S. and F.M.S. Scientific Series No. 19. 21 pp., 1 plate, 1 graph, 1937. Price 50 cents (Straits Currency).

In Part I of "Lac in Malaya", published by the Department of Agriculture, Straits Settlements and Federated Malay States, in 1933 (Scientific Series No. 11), the writer gave an account of attempts to propagate a species of lac-bearing insect, *viz. Laccifer javanus* Chamb., as well as descriptions of this insect and of some of its natural enemies. This species was discovered living on *Macaranga megalophylla* M.A. and *Ficus polysyce* Ridl., growing in swampy jungle.

These attempts, which were abortive, demonstrated that *L. javanus* was unsuitable for propagation. However, since the establishment of a new cottage industry was considered highly important, brood-lac of *Laccifer lacca* (Kerr) was obtained from the Lac Research Institute, Namkum, India, for a further series of experiments which forms the subject matter of the present publication.

Three attempts, which are described by the author, were made to propagate this species in Malaya, but they were unsuccessful. The main host-plants utilized were: rain tree (*Enterolobium saman* Prain, *Cajanus indicus* Spreng and *Zizyphus jujuba* Lam. In addition, a small experiment of inoculating plantation rubber trees (*Hevea brasiliensis* Muell.) was also carried out.

In view of these failures, the conclusion is reached that conditions in Malaya are unfavourable to the propagation of lac.

D. H. G.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports of Agricultural Officers.

February, 1937.

The Weather.

The dry weather continued in Kedah throughout the month and similar dry conditions obtained in Penang, but some heavy showers fell towards the end of the month in Province Wellesley and Krian. In many parts of the inland areas of Perak and Selangor, rainfall was above normal for the month, but portions of the coast were very dry, notably Kuala Selangor and Sitiawan. In Negri Sembilan, the rainfall was slightly above normal at Seremban but the Districts of Kuala Pilah and Jelebu shared the dry conditions of Segamat in Johore, and Tampin shared the dry weather that prevailed in Malacca. On the east coast of Pahang and in Kelantan dry conditions obtained. In inland Pahang the rainfall at Temerloh was below normal but Bentong shared in the heavier rainfall of the inland areas of Selangor. The weather in Singapore was dry during the first part of the month but showers fell during the last week. Very dry weather prevailed in Brunei.

Remarks on Crops.

Padi.—Heavy showers of rain interfered with harvesting in Central Province Wellesley and in Krian towards the end of the month and to some extent in the Sungei Manik area of Lower Perak. The harvest is generally late in both Province Wellesley and Krian and it would appear probable that yields will be somewhat below those of last season. In the Larut District of Perak the crop is also likely to be only fair but prospects are better in the Kuala Kangsar District. A good crop is expected on the oldest established area at Sungei Manik, but in many other portions of Stage I rat damage will reduce the crop materially on lands where tree stumps are present in quantity. At Panchang Bedina in Selangor an area of 11,500 acres has been planted and the crop has made good growth and looks very promising, notwithstanding dry weather, except in the north-east portion where rat damage has been severe. A satisfactory crop is expected in Negri Sembilan generally except in the Kuala Pilah District where planting was very irregular and generally late. The Malacca crop is expected to be somewhat better than that of last season. In Kelantan the harvesting of wet padi is in progress, but the operation will be very prolonged as some areas are not yet in flower. The crop from both wet and dry padi is expected to be poor. In Brunei, crop prospects are considered to be good.

Rubber.—The Penang price remained fairly steady during the month between $45 and $47 per picul for smoked sheet. This month's reports record a drop in

prices for those rural areas which had not recorded a decline in last month's returns. Most reports record decreased yields on account of wintering, and some indicate a narrowed price margin between good and inferior grades and between smoked and unsmoked sheet.

A summary of the reports on smoke cabinets is interesting. In Penang four cabinets were working during the month and the smoked sheet produced commanded a premium of $2 a picul, whereas the highest premium offered in Province Wellesley was 70 cents. In the Krian Circle of Perak none of the cabinets at Bukit Merah was used, yet one at Pondok Tanjong continued to function and the owner obtained a premium of $2 a picul. The three cabinets at Trong in North Perak were in operation, but none of those erected in the Batang Padang District. In Ulu Bernam, Selangor, five cabinets were in operation and the premium obtained for smoked sheet ranged from $2 to $2.20 a picul, although the State Agricultural Officer states that the sheet produced was not of high quality. Eleven cabinets were working in East Pahang. In Kelantan, five were under construction during the month and the State Agricultural Officer records that a certain amount of smoked sheet is now produced instead of practically all lump rubber as was the case formerly. In North Johore, one cabinet at Segamat and three in Muar continued to function, but all the remainder were idle. Smoke cabinets have become popular in Brunei where forty-three are functioning regularly, fourteen having been erected during the current month.

It is well known that many dealers in rural areas have never attempted to do any grading of small-holders' rubber, but have bought and sold the commodity as if it were all of a uniform standard. It is suggested that it is possible that this fact may account for the low premium at first offered for smoked sheet when a smoke cabinet commences operation in a *kampong* area, and that once the dealer has become accustomed to grading he is prepared to offer a higher premium for smoked sheet. The case of Ulu Bernam is interesting in this respect, for a few months ago it was reported that a dealer in that area refused to buy smoked sheet, whereas now up to $2.20 premium is paid. In this instance, however, other factors may be responsible, for it is known that there has been propaganda on the point by Co-operative and Agricultural Officers.

Coconuts.—Fluctuations in the price of copra have led to a good deal of speculation by dealers in the larger coconut areas as is usual under such circumstances. Nuts still continue to be scarce and the fact is specially mentioned in the Selangor report this month, where it is stated that insufficient nuts were available to keep the kilns working regularly.

Further drying cabinets were erected during the month, but in many instances the owners have departed from the dimensions recommended. It seems desirable to emphasize that these new type drying cabinets cannot be expected to function satisfactorily or to make good quality copra if the dimensions recommended are not closely followed.

Tuba (*Derris*).—Tuba growing on a commercial scale has in the past been practically confined to a few large estates and to lands worked by Chinese, the latter often held under temporary occupation licence. During recent months several references have been made in monthly reports to Malays planting this crop in parts of Pahang, Perak and Selangor.

Agricultural Stations and Test Plots.

Agricultural Stations.—It was recorded in these notes some few months ago that it had been decided to utilize Cheras Station mainly for poultry and fruit. Stocking with poultry was begun during the month with a number of day-old chicks from the School of Agriculture. A brooder shed and three chick runs were completed, and sufficient equipment for present requirements in the shape of two brooders and a night ark was installed. The fruit area is under preparation for rearing runs and a potting shed was erected.

At Rembau Station work is in progress on an extension to the poultry runs, and additional poultry houses and cockerel coops are being constructed. At the Johore Pineapple Station sites for a plant house and office were demarcated and the planting of a comprehensive experiment was commenced. Further development work proceeded satisfactorily at the Central, Tenglu and Tangkak Stations in Johore.

Padi Stations and Plots.—Harvesting was in progress at all Stations and Plots where not previously completed. Weather interfered with the work at Bukit Merah, several of the Krian Plots and at Sungei Manik Station.

DEPARTMENTAL NOTES.

A Classified List of Principal Articles published in the *Malayan Agricultural Journal.*

A Classified List of principal articles which had appeared in the first eighteen volumes of the monthly journal of the Department of Agriculture was compiled, in the first place, for departmental use. In order that the List might be made available to a wider range of students of Malayan Agriculture, it was published in 1931.

The Classified List has now been revised to include the twenty-three volumes and thus brings the subject matter up to the end of 1935. In addition, the information contained in the first edition of the list has been carefully revised. A copy of the revised List has been issued free to all subscribers of the *Malayan Agricultural Journal,* and was distributed with the February 1937 number of this Journal.

It should be explained that the monthly publications of the Department of Agriculture commenced with *The Agricultural Bulletin of the Federated Malay States* in August, 1912. With the tenth volume (1922) the title was changed to *The Malayan Agricultural Journal,* but no material alterations were made in the format. With the eighteenth volume (1930) the size and format of the Journal were considerably altered, but its title was retained.

Some of the articles are now of little more than academic interest, but many of them represent pioneer work which has since been translated into the ordinary practice of planting in Malaya. This record of work performed during the past twenty-four years is evidence of the wide field covered by the activities of the Department.

Transfer.

Mr. G. D. P. Olds, Agricultural Officer, reported his arrival in Brunei on 10th February 1937 and assumed duty as Agricultural Officer, Brunei and Labuan, as from 11th February 1937.

Leave.

Mr. G. H. Corbett, Government Entomologist, has been granted 8 months and 30 days leave from 18th February to 16th November 1937. During his absence, Mr. N. C. E. Miller will act as Government Entomologist.

Mr. W. G. Higgins, Acting Agricultural Officer, Singapore, proceeded on leave on 9th February 1937, prior to relinquishment of appointment.

Mr. R. G. Heath returned from leave on 28th January 1937 and assumed duty as State Agricultural Officer, Kelantan, with effect from 4th February. Mr. H. K. Ashby relinquished duty as State Agricultural Officer, Kelantan, and assumed duty as Agricultural Officer, Singapore, on 9th February.

Mr. D. H. Grist, Agricultural Economist and Editor, returned from leave on 20th February 1937 and assumed the duties of his appointment.

Statistical.

MARKET PRICES.

February 1937.

Major Crops.

Rubber.—The price of rubber fluctuated slightly during the month, but improved on the opening quotations. Spot loose opened in Singapore at 35½ cents per lb., and, after an early improvement, fell back to 34⅞ cents on the 19th, recovering to 36⅝ on the 26th, and closing at 36¼ cents.

The average price for the month of No. 1 X. Rubber Smoked Sheet was 35.89 cents per lb. as compared with 36.47 cents in January. The London average price was 10.48 pence per lb., and the New York price 21.21 cents gold as compared with 10.38 pence and 21.26 cents gold in January.

Prices paid for small-holders' rubber at three centres during the month are shewn in Table I.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, February, 1937.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.			Kuala Kangsar, Perak.			Batu Pahat, Johore.			
	4	18	25	3	17	24	3	10	17	24
Smoked sheet	44.24	45.50	45.39	44.00	45.00	45.19		45.00	44.40	44.50
Unsmoked sheet	43.07	44.46	44.32				42.30	43.00	42.60	43.00
Scrap										

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

No purchases at Kuala Kangsar on the 10th February, and at Kuala Pilah on the 11th February.

Palm Oil.—The market weakened during February, and prices for the Malayan commodity are shewn in Table II.

Table II.
Prices of Palm Oil and Palm Kernels.

Date 1937.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
February 5	£ 27. 10. 0	£ 15. 0. 0
,, 12	26. 0. 0	15. 0. 0
,, 19	26. 0. 0	14. 15. 0
,, 26	25. 0. 0	14. 10. 0

Copra.—The market fell back still further at the beginning of the month, but recovered substantially, weakening again towards the close, but actually closing with an upward tendency. The sun-dried grade opened in Singapore at $7.30 per picul and reached $8.60 on the 16th February; thereafter it fell steadily to $7.60 on the 25th, but closed at $7.85, the average price for the month being $7.92 per picul as compared with $9.26 in January. The mixed grade averaged $7.65 per picul as compared with $9.01 in the previous month.

Copra cake continued unchanged throughout the month at $2.25 per picul. The January average price was $2.20.

Rice.—The average wholesale prices of rice per picul in January were as follows:— Siam No. 2 (ordinary) $4.95, Rangoon No. 1 $3.67, Saigon No. 1 $4.50 as compared with $4.35, $3.47 and $3.92 in December. The corresponding prices in January 1936 were $3.64, $3.45, and $3.37.

The average retail prices in cents per gantang of No. 2 Siam rice in January were: Singapore 32, Penang 37, Malacca 35, as compared with 28, 31 and 30 respectively in December.

The average declared trade value of imports of rice in January was $4.00 per picul as compared with $3.74 in December and $3.47 in November. The average declared trade value for 1936 was $3.58 per picul, as compared with $3.65 for 1935.

Padi.—The Government Rice Mills, Perak, commenced paying $1.90 per picul for padi in February, but quickly raised the price to $2 per picul. A privately owned mill paid $2 per picul together with a commission of 2, 5 or 10 cents according to the quantity brought in.

Retail prices of padi ranged from 7 to 14 cents per gantang.

Pineapples.—Prices of canned pineapples weakened slightly at the end of February. Average prices for the month per case were: Cubes $3.19, Sliced Flat $3.10, Sliced Tall $3.24, as compared with $3.13, $3.01 and $3.23 respectively in January.

Prices of fresh fruit per 100 were: Selangor $1.20 to $2; Singapore $1.80. In Johore the range of prices was considerable, *i.e.*, 1st quality $1.20 to $5, 2nd quality 90 cents to $4, 3rd quality 70 cents to $2.

Beverages.

Tea.—Six consignments of tea were sold on the London market during February, one of which, of upland tea, averaged 1s. 3¾d. per lb. The average prices realized for the consignments of lowland tea ranged from 1s. 0¾d. to 1s. 2d. per lb.

Average London prices per lb. during January for consignments of tea from other countries were as follows: Ceylon 1s. 4.10d., Java 1s. 1.38d., Indian Northern 1s. 1.93d., Indian Southern 1s. 2.00d., Sumatra 11.60d.

The latest Colombo average prices available, quoted from the *Weekly Tea Market Report*, 23rd February, 1937, of the Colombo Brokers' Association are as follows in rupee cents per lb.:—High Grown Teas 93 cents, Medium Grown Teas 77 cents, Low Grown Teas 72 cents.

Coffee.—Prices in Singapore fell during February. Sourabaya averaged $14.62 to $17.62 per picul as compared with $16.88 to $18.19 in the previous month, and Palembang averaged $10.69 to $11.81 as against $13.16 to $14.19 in January.

Spices.

Arecanuts.—The following are the averages of the ranges of Singapore prices per picul during February: Splits $5.94 to $8.06, Red Whole $5.94 to $7.00, Sliced $11.62 to $13.69.

The Singapore Chamber of Commerce quotations per picul were:—Best $7.00, Medium $6.25, Mixed $6.00.

Pepper.—The market was stagnant during the month and prices were marked down at the close. Average prices per picul for February were: Singapore Black $11.38, Singapore White $19.88, Muntok White $20.38, as compared with $11.80, $20.60 and $21.20 in January.

Nutmegs.—Both 110's and 80's remained unchanged throughout the month at $30 per picul, as compared with an average price of $30.20 in January.

Mace.—Siouw continued at $100 per picul, and Amboina was quoted throughout the month at $80 per picul as compared with an average price of $77 in January.

Cloves.—Nominal quotations throughout February for both Zanzibar and Amboina were $40 per picul.

Cardamoms.—Green cardamoms were quoted in Ceylon Chamber of Commerce reports at Rs. 2.40 to Rs. 2.55 rising to Rs. 2.61 to Rs. 2.71, but closing at Rs. 2.40 to Rs. 2.63.

Miscellaneous.

Derris (*Tuba Root*).—The market improved during February with consumers shewing more interest though not actively buying, and supply small. The average price for roots sold on rotenone content was $49 per picul, and for roots sold on a basis of ether extract $32 per picul, as compared with $47 and $30 in January.

Gambier.—Block remained unchanged at $7 per picul and No. 1 Cube at $15 per picul. The January average prices were $6.20 and $13.10 respectively.

Tapioca.—Seed Pearl improved 25 cents at the close to average $5.81 per picul as compared with $5.75 in January, and Flake Fair and Medium Pearl continued unchanged at $5.50 and $6.50 per picul respectively.

Sago.—Pearl, Small Fair, was quoted throughout February at $5.25 per picul, and Flour, Sarawak Fair, improved to $4.10 per picul, averaging $3.88. The January average prices were $5.02 and $3.53 respectively.

Tobacco.—The general range of prices per picul was as follows:—1st quality $29.50 to $55, 2nd quality $25 to $34, 3rd quality $12 to $25. In Johore, prices ranged from $32 to $80; in Kelantan the range was $107.50, $87.50, $70, and in Kedah $45 to $50, $30 to $40, $20 to $25.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57 Trafalgar Square, London, W.C. 2.

GENERAL RICE SUMMARY.*

January, 1937.

Malaya.—Imports of foreign rice during January were 56,488 tons,† and exports 13,101 tons. Net imports were accordingly 43,387 tons as compared with 34,226 tons in 1936.¶

Of the January imports, 52 per cent. were consigned to Singapore, 12 per cent. to Penang, 8 per cent. to Malacca, 22 per cent. to the Federated Malay States, and 6 per cent. to the Unfederated Malay States. The imports by countries of origin were as follows (in tons, percentages in brackets): Siam 37,788 (66.9), Burma 17,271 (30.6), French Indo-China 66.7 (1.2), other countries 762 (1.3).

Of the exports during January, 56 per cent. were consigned to the Netherlands Indies and 44 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):— Siam 10,101 (77.1), Burma 2,078 (15.9), French Indo-China 507 (3.9), parboiled 347 (2.6), local production 68 (0.5).

India and Burma.—Foreign exports during 1936 totalled 1,319,000 tons as compared with 1,637,000 tons in 1935, a decrease of 19.4 per cent. Of these, 3.6 per cent. were to the United Kingdom, 14.3 per cent. to the Continent of Europe, 31 per cent. to Ceylon, 22.2 per cent. to the Straits Settlements and the Far East, and 28.9 per cent. to other countries. The corresponding percentages for 1935 were 3.7, 9.3, 31.2, 26.4, and 29.4.

The fourth forecast of the rice crop in Burma for the year 1936-37 (*Bangkok Times*, 8th February 1937) puts the yield at about 7,067,800 tons of padi, as against 7,758,800 tons estimated at the same time in 1936. The exportable surplus is estimated at 2,850,000 tons of rice and rice products.

Siam.—Exports of rice and rice products from Bangkok during November 1936 were 122,284 tons; the cumulative total for the eleven months was 1,503,385 tons as compared with 1,388,119 tons in 1935.

Japan.—The latest information available was published in the November Summary.

French Indo-China.—Entries of padi into Cholon during January were 141,498 tons, as compared with 138,410 tons in 1936, an increase of 2.2 per cent. Exports of rice in the same period were 88,761 tons, as compared with the 1936 figure of 59,207 tons, an increase of 49.9 per cent.

The Netherlands Indies.—According to the *Netherlands Indies Economic Bulletin*, Vol. IV, 1st December, 1936, the area under padi harvested from 1st

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* Abridged from the Rice Summary for November, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† Ton = long ton (2,240 lbs.)

¶ It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935 or 1936.

January to 30th September 1936, was 8,877,180 acres, as against 8,578,310 acres in the corresponding period of 1935, an increase of 3.5 per cent.

Ceylon.—Imports during January were 48,852 tons as compared with 53,617 tons in 1936, a decrease of 8.9 per cent. Of these imports 14.7 per cent. were from British India, 70.9 per cent. from Burma, 0.6 per cent. from the Straits Settlements, and 13.8 per cent. from other countries. The relative 1936 percentages were 6.5, 69.5, nil, and 24.0

Europe and America.—Shipments to Europe from the Far East totalled 1,386,012 tons in 1936, as compared with 827,236 tons in 1935, an increase of 67.5 per cent. Of these shipments 22.0 per cent. were from Burma, nil from Japan, 67.5 per cent. from Saigon, 9.8 per cent. from Siam, and 0.7 per cent. from Bengal. The 1935 corresponding percentages were 39.4, 2.9, 50.5, 5.9 and 1.3.

Shipments for the Levant from the 1st January to the 13th December 1936 were 13,680 tons as compared with 28,895 tons in 1935, a decrease of 52.7 per cent. Shipments to Cuba, West Indies and America during the same period were 247,108 tons, a decrease of 7.9 per cent. when compared with the 1935 figure of 268,378 tons.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS (IN LONG TONS)

(As declared by Estates)

Month 1937	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January ...	1,984.8	865.0*	360.4	156.0*
January 1936 ...	1,395.4	326.5	258.6	37.2
Total for the year 1936 ...	23,081.2	8,812.3	3,791.0	1,340.7

* Johore returns incomplete.

MALAYAN RUBBER STATISTICS

Acreages of Tappable Rubber not Tapped on Estates of 100 Acres and over, for the Month ending 31st January, 1937.

State or Territory	Acreage of Tappable Rubber end 1935	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Straits Settlements :—									
Province Wellesley	44,526	210	0.5	17,736	39.8	472	1.1	17,946	40.3
Malacca	121,601	1,405	1.2	45,169	37.1	3,184	2.6	46,574	38.3
Penang Island	2,575	675	26.2	918	35.7	208	8.1	1,593	61.9
Singapore Island	34,525	4,954	14.3	11,489	33.3	341	1.0	16,443	47.6
Total S.S. ...	203,227	7,244	3.6	75,312	37.0	4,205	2.1	82,556	40.6
Federated Malay States :—									
Perak	294,988	7,699	2.6	92,642	31.4	13,960	4.7	100,341	34.0
Selangor	332,165	7,884	2.4	99,357	29.9	17,017	5.1	107,241	32.3
Negri Sembilan	258,304	5,636	2.2	79,374	30.7	17,055	6.6	85,010	32.9
Pahang	77,210	6,765	8.8	23,812	30.8	16,208	21.0	30,577	39.6
Total F.M.S. ...	962,667	27,984	2.9	295,185	30.7	64,240	6.7	323,169	33.6
Unfederated Malay States :—									
Johore	432,443	17,716	4.1	44,307	10.2	41,623	9.6	62,023	14.3
Kedah	199,607	12,756	6.4	25,049	12.5	14,588	7.3	37,805	18.9
Kelantan	30,474	403	1.3	7,598	24.9	3,609	11.8	8,001	26.2
Trengganu (b)	4,643	Nil	Nil	Nil	Nil	100	2.2	Nil	Nil
Perlis (c)	1,575	Nil	Nil	740	47.0	177	11.2	740	47.0
Brunei	6,010	Nil	Nil	1,301	21.6	882	14.7	1,301	21.6
Total U.M.S. ...	674,752	30,875	4.6	78,995	11.7	60,979	9.0	109,870	16.3
Total Malaya ...	1,840,646	66,103	3.6	449,492	24.4	129,424	7.0	515,595	28.0

Notes :—(a) Area out of tapping on estates which have partly ceased tapping refers to areas definitely being rested and includes areas rested under rotational systems in respect of S.S. and F.M.S. but excludes areas on any tapping round for U.M.S.

(*b*) Registered companies only.

(*c*) Rendered quarterly.

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY, 1937, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January 1937		during the month		January 1937						
	Ports	Dealers	Estates of 100 acres and over	during the month	January 1937	during the month	January 1937	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January 1937
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	3,682	14,568	13,706	13,706	7,037	7,037	Nil	Nil	Nil	Nil	12,463	3,330	12,463	3,330	...	8,771	14,409	20	20
Johore ...	...	1,750	5,116	5,534	5,534	4,131	4,131	Nil	111	Nil	111	2,693	6,594	2,693	6,594	...	2,309	5,046	...	...
Kedah ...	...	156	3,762	3,454	3,454	1,331	1,331	Nil	Nil	Nil	Nil	2,096	2,317	2,096	2,317	...	496	3,794	...	...
Perlis ...	...	1	21	17	17	26	26	Nil	Nil	Nil	Nil	Nil	32	Nil	32	...	13	20	...	...
Kelantan ...	...	189	295	368	368	695	695	Nil	Nil	Nil	Nil	186	710	186	710	...	352	299	...	...
Trengganu ...	...	55	50	183	183	92	92	Nil	Nil	Nil	Nil	Nil	275	Nil	275	...	55	50	...	...
Brunei ...	...	Nil	46	61	61	85	85	...	...	...	...	...	131	...	131	...	13	48	...	...
Total Malay States	...	5,833	23,858	23,323	23,323	13,397	13,397	Nil	111	Nil	111	17,438	13,389	17,438	13,389	...	12,009	23,666	20	20
S. SETTLEMENTS :—																				
Malacca ...	...	1,723	1,340	1,409	1,409	651	651	Nil		Nil		2,940		2,940		...	2,200	1,283	...	...
Province Wellesley ...	...	1,536	657	595	595	217	217	Nil		Nil		5,419		5,419		...	1,834	702	...	...
Penang ...	1,786	3,266	11	16	16	79	79	4,097	14.175	4,097	14.175	15.774	Nil	15.774	Nil	6,980	22,068	189	33	33
Singapore ...	7,166	14,751	178	161	161	48	48	12,801		12,801		Nil		Nil		...	15	Nil	...	...
Labuan ...	...	9	Nil	Nil	Nil	13	13	58		58										
Total Straits Settlements ...	8,952	21,285	2,186	2,181	2,181	1,008	1,008	16,956	14,175	16,956	14,175	24,133	Nil	24,133	Nil	8,616	31,798	2,187	33	33
Total Malaya ...	8,952	27,118	26,044	25,504	25,504	14,405	14,405	16,956	14,286	16,956	14,286	41,571	13,389	41,571	13,389	8,616	43,807	25,853	53	53

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	7,379	21,218	5,158	3,713	1,807	251
WET RUBBER	1,392	850	523	349	502	245
TOTAL ...	8,771	22,068	5,681	4,062	2,309	496

TABLE III
FOREIGN EXPORTS

PORTS 29	For month 30	January 1937 31
Singapore ...	26,432	26,432
Penang ...	9,713	9,713
Port Swettenham.	5,197	5,197
Malacca ...	229	229
MALAYA ...	41,571	41,571

TABLE IV
DOMESTIC EXPORTS 4

AREA 32	For month 33	January 1937 34
Malay States ...	30,439	30,439
Straits Settlements	2,699	2,699
MALAYA ...	33,138	33,138

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 3rd March, 1937.

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1937.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	90.0	71.3	80.7	95	64	79	75	83.1	84.0	9.35	237.5	4.15	16	11	4	7		199.50	6.43	53
Bukit Jeram, Selangor ...	87.5	71.8	79.7	91	66	81	75	83.1	84.7	11.10	281.9	3.53	16	16	9	4		231.70	7.47	62
Sitiawan, Perak ...	88.0	71.8	79.9	91	62	85	75	82.9	83.7	7.96	202.2	1.75	17	12				226.55	7.31	62
Temerloh, Pahang ...	85.9	71.0	78.5	91	65	77	74	82.8	84.0	9.55	242.6	2.09	16	12		4		187.95	6.06	51
Kuala Lipis, Pahang ...	86.4	69.8	78.1	90	63	80	73	81.9	83.1	7.36	186.9	1.93	15	14		23		186.55	6.02	51
Kuala Pahang, Pahang ...	83.7	74.2	78.9	86	65	80	77	81.6	83.1	10.18	258.6	3.80	15	15			1	209.85	6.77	57
Kallang Aerodrome, S'pore ...	86.0	74.2	80.1	89	70	76	77	80.9	82.2	8.16	207.3	3.09	14	13	1			181.55	5.86	48
Butterworth, Province Wellesley ...	87.8	72.0	79.9	91	65	84	75	84.1	84.9	4.58	116.3	1.69	11	7	3		1	257.70	8.31	70
Bayan Lepas Aerodrome Penang ...	88.0	72.8	80.4	91	66	84	76	83.0	83.4	2.57	65.3	1.14	7	7	5			249.55	8.05	68
Bukit China, Malacca ...	86.3	72.3	79.3	90	68	76	75	80.9	82.5	3.48	88.4	1.79	14	12	2			196.35	6.35	53
Kluang, Johore ...	86.1	71.1	78.6	91	65	78	74	79.9	81.2	7.94	201.7	2.91	18	13		2		183.91	5.93	49
Bukit Lalang, Mersing, Johore	82.4	73.0	77.7	84	67	80	76	79.3	79.8	6.69	169.9	1.68	16	13			2	182.15	5.87	49
Alor Star, Kedah ...	89.1	70.2	79.7	95	62	85	75	82.6	83.7	0.15	3.8	0.07	3	2			1	252.25	8.14	69
Kota Bahru, Kelantan ...	84.7	71.6	78.1	87	63	82	76	81.3	82.5	5.18	131.6	1.06	15	13		3		215.32	6.95	59
Kuala Trengganu, Trengganu	83.7	71.9	77.8	85	64	80	76	80.1	81.2	4.62	117.4	1.40	17	14		3	1	218.05	7.03	59
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	71.3	60.6	65.9	76	53	65	63	71.1	71.2	12.51	317.8	2.48	16	15		18		147.85	4.77	40
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.4	53.7	63.1	77	36	66	61	68.8	69.3	3.95	100.3	0.98	13	10			3	151.00	4.87	41
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.4	57.9	64.7	77	51	65	60			3.72	94.5	0.87	11	8			3	150.20	4.85	41

Compiled from Returns supplied by the Meteorological Branch, Malaya.